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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : F16K 27/06	A1	(11) International Publication Number: WO 91/06797
		(43) International Publication Date: 16 May 1991 (16.05.91)

(21) International Application Number: PCT/IT90/00088

(22) International Filing Date: 31 October 1990 (31.10.90)

(30) Priority data:
67931 A/89 2 November 1989 (02.11.89) IT

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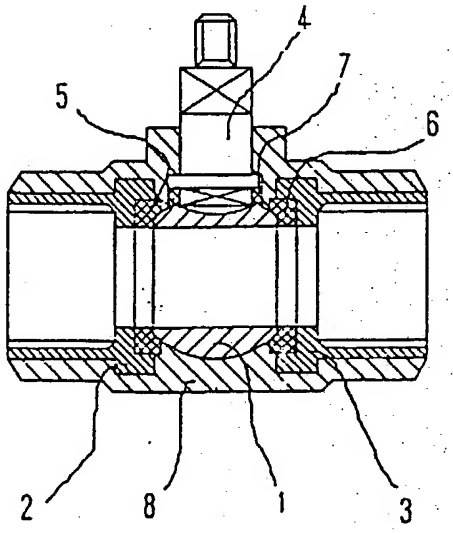
(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (Utility model), DE (European patent), DK, DK (European patent), ES (Utility model), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
With amended claims.

(54) Title: A SPHERICAL PLUG VALVE AND A METHOD FOR MANUFACTURING THE SAME



(57) Abstract

A valve for a fluid distribution system is disclosed, which has a spherical plug (1), a control stem (4), sealing rings (5, 6) and coupling sleeves (2, 3) enclosed into a body of a plastic material (8). Said enclosed valve members are maintained in position and forced against each other by said body with a predetermined pressure to ensure sealing without impairing the plug movements. For manufacturing the valve, the valve members are placed into a die of a press for injection molding of plastic materials and plastic material is injected into the die. After setting, the plastic material forms the valve body.

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A valve according to the invention comprises a spherical plug coupled to a control stem, a pair of tubular coupling members at opposite sides of the spherical plug and sealing rings placed between the control stem and the spherical plug and between the spherical plug and the tubular coupling members, and is characterized in that it also comprises a casing of a plastic material which forms the valve body and encloses therein said spherical plug, at least a portion of said tubular coupling members, a portion of said control stem adjacent to the spherical plug and said sealing rings, thereby maintaining said enclosed valve members in position and forcing the same against each other with a predetermined pressure to ensure sealing without impairing the plug movements.

A method according to the invention for manufacturing a valve as described above comprises the steps of placing the valve members, arranged in the relative positions which they are intended to have in the finished valve, on valve member bearing means of a die of a press for injection molding plastic materials, which comprises two separate portions and has a cavity having an overall shape complementary to the external shape of the valve and a size to leave a gap between the cavity walls and the exposed surface of the valve members; closing the die; injecting a moldable plastic material into said gap to fill entirely said gap; and hardening said plastic material; the hardened plastic material forming a valve

"A SPHERICAL PLUG VALVE AND A METHOD FOR MANUFACTURING THE SAME"

DESCRIPTION OF THE INVENTION

This invention relates to valves for fluid distribution systems and, more particularly, to a spherical plug valve and a method for manufacturing the same.

A conventional spherical plug valve comprises a metallic body, which includes a seat for the plug, a control stem coupled to the plug and a pair of metallic sleeves which are threaded to the body for holding the plug in its seat. Sealing rings of a low friction material, typically Teflon, are located between the sleeves and the plug and between the plug and the control stem. For assembling the valve, it is necessary to provide threads in the portions of the body and the sleeves to be mutually engaged and then screw the sleeves onto the body after inserting the corresponding sealing rings. This procedure is rather time-consuming and requires a high accuracy to avoid that the sleeves are either overtightened, so that the plug is locked, or undertightened, thereby failing to obtain a perfect valve sealing.

It is an object of this invention to provide a valve and a manufacturing method wherein the pressure between the valve members is automatically obtained and the manufacturing time is substantially shortened in comparison with the prior art.

body enclosing said valve members.

A detailed description of a preferred embodiment of the invention is described in the following in connection with the enclosed drawings, wherein:

Fig. 1 is a section view of a valve according to the invention and

Figs. 2 and 3 are simplified section views of a die used to implement the method according to the invention, with a valve in its cavity.

As shown in Fig. 1, a valve according to the invention comprises a spherical plug 1 and two tubular members 2 and 3 adjacent to the plug. The tubular members 2 and 3 are shaped as metal sleeves which have their internal surfaces threaded for connection with respective pipes (not shown). The plug 1 has a notch receiving a corresponding key of a control stem 4, operable by a control lever (not shown). Sealing rings 5 and 6 are received into corresponding seats provided in the end sides of the sleeves 2 and 3 adjacent to the spherical plug 1. Another sealing ring 7 is provided between the control stem 4 and the plug 1. These valve members are of a conventional kind.

The sleeves, plug and control stem can be made, for example, of brass or steel and the sealing rings are preferably of polytetrafluoroethylene (Teflon).

The sleeves 2 and 3, the spherical plug 1, the control stem 4 (except its end portion to be engaged by the control lever) and the sealing rings 5, 6 and 7 are enclosed into a casing 8 of a plastic material and are

pressed against each other by the casing itself with such a pressure to ensure sealing without impairing the plug operation. This casing is the body of the valve. A suitable plastic has proved to be glass filled nylon.

To manufacture the valve, a press for injection molding of plastic articles can be used, having a die as shown diagrammatically in Figs. 2 and 3. For the sake of clarity, the ducts for injecting fluid plastic material into the die are not shown.

As shown in Fig. 2, the die has a movable portion 8 and a fixed portion 9 formed each with a cavity (in the axial direction) 10 and 11, respectively, accomodating a half of the valve and having a combined shape which is substantially complementary to the outside surface of the valve. A stud 12 is provided in the movable portion 8 to hold the valve members in the positions that they are intended to take in the finished valve, with the sealing rings 5, 6 and 7 contacting the spherical plug 1. An alignment stud 13 projects from the bottom wall of the cavity 11 to engage the end portion of the sleeve 3 when the die is closed (Fig. 3).

As shown in Fig. 3, the cavities 10 and 11 are so dimensioned that a gap 14 is left between the cavity walls and the exposed surfaces of the valve members. When the die is closed, the sleeves and the control stem are subjected to a certain pressure against the corresponding sealing rings.

After closing the die, plastic material is injected

into the die to fill the gap 14. Then the plastic is hardened, or set, to form a valve body 8. During setting, the plastic material shrinks, thereby forcing even more the sleeves and the control stem against the sealing rings, which are pressed in turn against the plug to ensure sealing of the valve. Now the die can be opened and the finished valve can be removed therefrom.

Obviously, the injection temperature and pressure will depend on the type of the selected plastic material. Similarly, the degree of compression on the valve members caused by the shrinkage will depend on the selected material and the injection conditions. A person skilled in the art of molding plastic materials can easily determine in each case the required operation parameters.

As appears clearly from the drawings, a liquid or a gas flowing through the valve does not get into contact anywhere with the plastic body, so that there is no corrosion problems.

The method according to the invention avoids any requirement of machining any valve members for the assembly of the same, so that finished valves can be obtained much more rapidly than the known valves. Furthermore, the metallic body forming a seat for the plug and a connection member to which the sleeves are threaded is eliminated, thereby saving metallic material. It is also important to point out that a plastic valve body provides the additional advantage of a longer valve life because the play caused by wear of the sealing rings,

which in the prior art valves jeopardizes the valve sealing after a given operation time, are compensated by the resilience of the plastic material. Furthermore, since no clearances exist between the valve seat and the valve plug because the valve seat has been formed directly on the plug, no deposits of foreign materials can form inside the valve and the problems associated therewith are avoided. As known, according to the kind of the foreign materials, these deposits can stiffen the valve operation, cause corrosion phenomena, contaminate the fluid flowing through the valve, etc.

While only one embodiment of the invention has been shown and described, it is obvious that many changes can be made without departing from the scope of the invention. For example, according to an embodiment still simpler and cheaper of the described one, the metallic coupling sleeves can be eliminated by shaping the valve plastic casing to form the plastic body with shoulders for holding the plug in position and suitable coupling means,such as threads, for connecting the valve to external pipes. In this case, the valve member bearing studs of the die should be shaped to have surfaces complementary to the surfaces of the tubular members to be formed in the plastic body. According to another modification, by appropriately shaping the die, the plastic casing which includes the valve body extend beyond either one or both the tubular members to form a member different from a sleeve, such as a cock, a hydrant coupling, or the like.

CLAIMS

1. A valve for a fluid distribution system comprising a spherical plug coupled to a control stem, a pair of tubular coupling members at opposite sides of the spherical plug and sealing rings placed between the control stem and the spherical plug and between the spherical plug and the tubular coupling members, characterized in that it also comprises a casing of a plastic material which forms the valve body and encloses therein said spherical plug, at least a portion of said tubular coupling members, a portion of said control stem adjacent to the spherical plug and said sealing rings, thereby maintaining said enclosed valve members in position and forcing the same against each other with a predetermined pressure to ensure sealing without impairing the plug movements.

2. A valve as claimed in claim 1, characterized in that the inside surface of said body contacts the outside surface of said valve members on the entire area thereof.

3. A method for manufacturing a valve as claimed in claims 1 and 2, characterized in that it comprises the steps of placing the valve members, arranged in the relative positions which they are intended to take in the finished valve, on valve member bearing means of a die of a press for injection molding plastic materials, wherein said die comprises two separate portions and has a cavity therein having an overall shape complementary to the external

shape of the valve and a size to leave a gap between the cavity walls and the exposed surfaces of the valve members; closing the die; injecting a moldable plastic material into said gap to fill entirely said gap; and hardening said plastic material; the hardened plastic material forming a valve body enclosing said valve members.

4. A method as claimed in claim 3, characterized in that the axial dimensions of the cavity are so selected that, when closing the die, the cavity walls impart a first compression to the ends of said tubular coupling members, wherein the final compression required for providing the valve sealing is obtained by the contraction of the plastic material during setting.

5. A valve for a fluid distribution system comprising a body, which includes a spherical plug coupled to a control stem, a pair of tubular coupling members at opposite sides of the spherical plug and sealing rings placed between the control stem and the spherical plug and between the spherical plug and the tubular coupling members, characterized in that said body and said tubular coupling members are made of a single portion of a plastic material which encloses therein said spherical plug, a portion of said control stem adjacent to the spherical plug and said sealing rings, thereby maintaining said enclosed valve members in position and forcing the same against each other with a predetermined pressure to ensure sealing without impairing the plug movements.

6. A method for manufacturing a valve as claimed in claim 5, characterized in that it comprises the steps of placing said spherical plug, said control stem and said sealing rings, arranged in the relative positions which they are intended to take in the finished valve, on valve members bearing means which are provided in a die of a press for injection molding plastic materials and have portions of their surfaces which have shapes complementary to the shapes of the inside surfaces of said tubular coupling members, wherein said die comprises two separate portions and has a cavity therein having an overall shape complementary to the external shape of the valve and a size to leave a gap between the cavity walls and the exposed surface of the valve members; closing the die; injecting a moldable plastic material into said gap to fill entirely said gap; and hardening said plastic material; the hardened plastic material forming a valve body enclosing said valve members.

8. A valve as claimed in claims 1, 2, or 5, characterized in that said plastic material is glass-filled nylon.

9. A method as claimed in claim 3, 4 or 6, characterized in that said plastic material is glass-filled nylon.

AMENDED CLAIMS

[received by the International Bureau on 26 March 1991 (26.03.91); original claims 5 and 6 cancelled; original claims 1,4,8 and 9 amended; other claims unchanged (2 pages)]

1. A valve for a fluid distribution system comprising a spherical plug coupled to a control stem, a pair of tubular metallic coupling members at opposite sides of the spherical plug and sealing rings placed between the control stem and the spherical plug and between the spherical plug and the tubular metallic coupling members, characterized in that it also comprises a casing of a plastic material which forms the valve body and encloses therein said spherical plug, at least a portion of said tubular metallic coupling members, a portion of said control stem adjacent to the spherical plug and said sealing rings, thereby maintaining said enclosed valve members in position and forcing the same against each other with a predetermined pressure to ensure sealing without impairing the plug movements.

2. A valve as claimed in claim 1, characterized in that the inside surface of said body contacts the outside surface of said valve members on the entire area thereof.

3. A method for manufacturing a valve as claimed in claims 1 and 2, characterized in that it comprises the steps of placing the valve members, arranged in the relative positions which they are intended to take in the finished valve, on valve member bearing means of a die of a press for injection molding plastic materials, wherein said die comprises two separate portions and has a cavity therein having an overall shape complementary to the external shape of the valve and a size to leave a gap between the cavity walls and the exposed surfaces of the valve members; closing the die: injecting a moldable

plastic material into said gap to fill entirely said gap; and hardening said plastic material: the hardened plastic material forming a valve body enclosing said valve members.

4. A method as claimed in claim 3, characterized in that the axial dimensions of the cavity are so selected that, when closing the die, the cavity walls impart a first compression to the ends of said tubular metallic coupling members, wherein the final compression required for providing the valve sealing is obtained by the contraction of the plastic material during setting.

5. A valve as claimed in claims 1 or 2, characterized in that said plastic material is glass-filled nylon.

6. A method as claimed in claim 3 or 4, characterized in that said plastic material is glass-filled nylon.

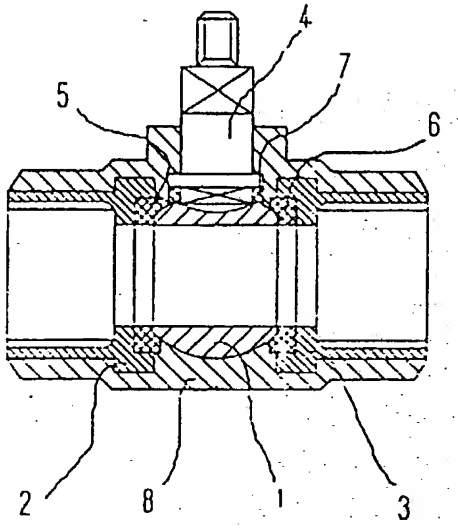

Fig. 1

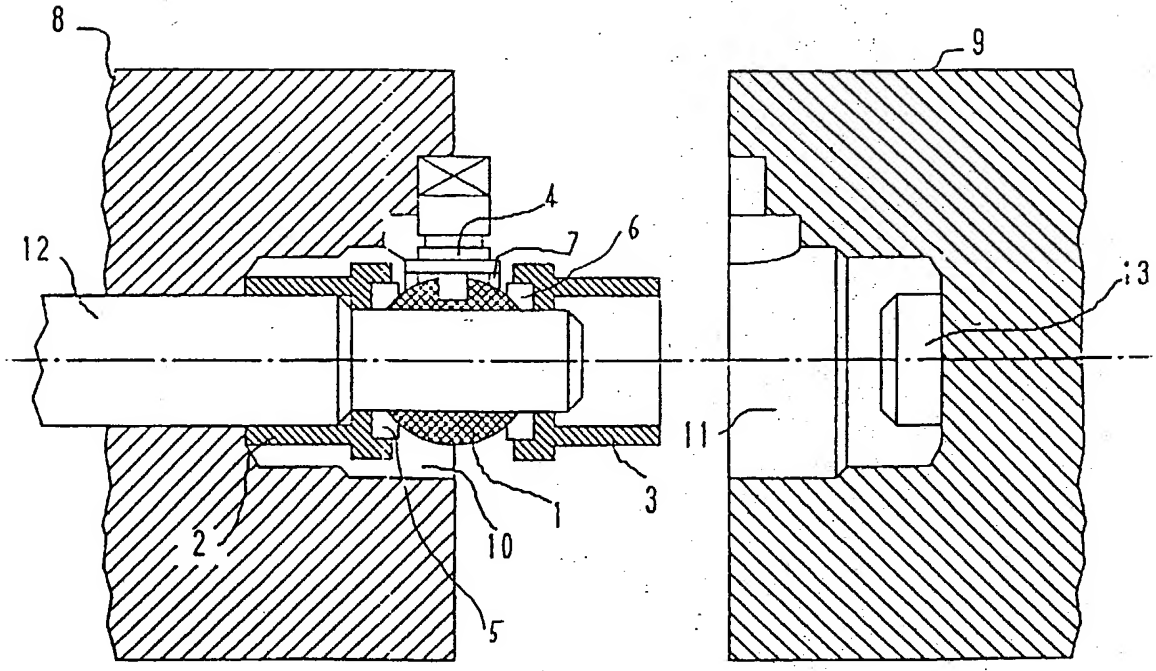

Fig. 2

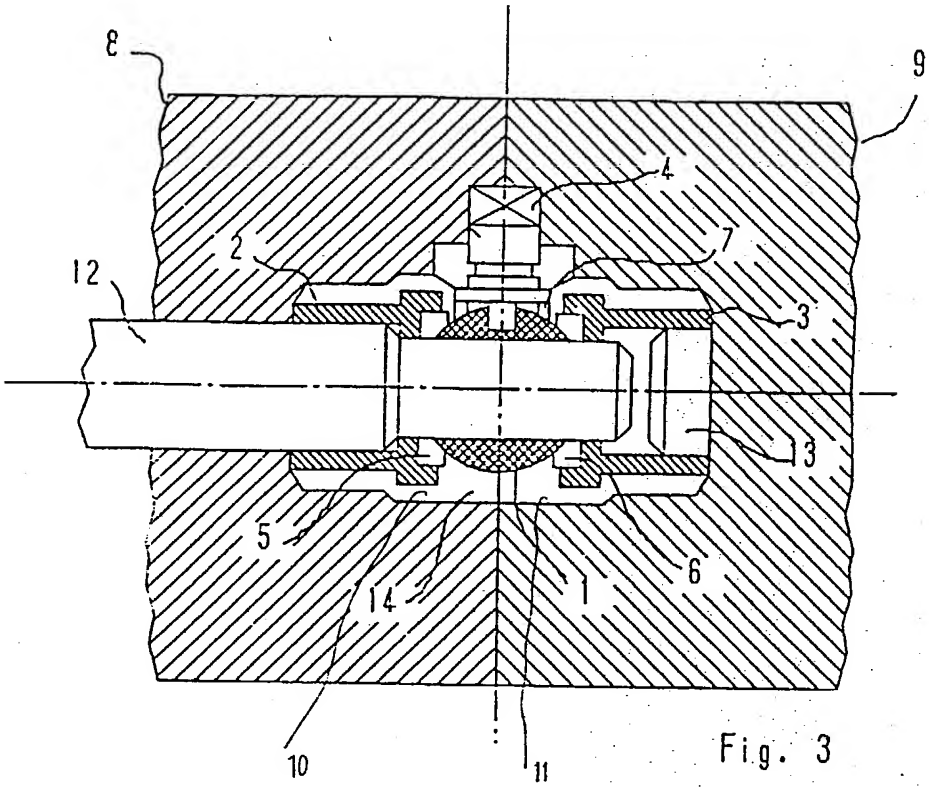

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 90/00088

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 F16K27/06

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	F16K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	GB,A,955194 (STUBBE) 15 April 1964 see page 1, lines 65 - 84; figures 1-3 see page 3, lines 2 - 19; figure 6	1-6
X	US,A,3807692 (USAB) 30 April 1974 see column 5, lines 9 - 65; figure 5	1-6
A	DE,A,2917200 (RICHARDS) 8 November 1979 see claim 10	8-9
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 153 (M-226) 5 July 1983, & JP-A-58 061378 (AISHIN SEIKI KK) 12 April 1983, see the whole document	8-9

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10 JANUARY 1991	28. 01. 91
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EUROPEAN PATENT OFFICE	CHRISTENSEN J.T.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-955194		None	
US-A-3807692	30-04-74	None	
DE-A-2917200	08-11-79	AU-A- 4601279	01-11-79